

ESAVE

Environmental Stewardship &
Value Engineering

Quarterly Newsletter for the Nuclear Weapons Complex



B Program P2 explodes outward at Lawrence Livermore's Site 300

Pollution prevention has risen to new heights, while waste generation has fallen to new lows at a Department of Energy (DOE) high explosives testing facility, thanks to the dedication of personnel from top to bottom within the Defense Programs organization there.

The B Program of Site 300 at Lawrence Livermore National Laboratory (LLNL) conducts non-nuclear high explosives testing, including hydrodynamic tests of devices and tests of explosive effects on components, structures, and weapon assemblies in support of DOE's Stockpile Stewardship Program. The variety of



Photo courtesy of Don Gonzalez, LLNL.

Aerial view of Site 300, Lawrence Livermore National Laboratory.

materials used in this destructive testing at the West Firing Area Bunker creates a potential for considerable amounts of waste.

B Program experiments are conducted at outdoor detonation sites or "firing tables." These gravel-covered pads hold test stands made of concrete, wood, or steel. During a typical "shot," an explosive device is ignited on the test stand; detonation cables set off the explosives, while signal cables from the device record velocity, time-of-arrival data, and other diagnostics.

Auxiliary components include explosive candles, a type of light source to illuminate the experiment, and mirror pads, which act as the shutter for high-speed cameras. Devices called "fire sets," equipped with capacitor discharge units (CDUs), control when

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Sandia/NM helps Navajo Tribal Utility Authority bring solar electricity to remote areas

A new solar power initiative of the Navajo Tribal Utility Authority (NTUA) is bringing electricity to the homes of people living in remote areas of the reservation.



Marlene Brown, a Sandia/NM engineer, travels once a month to Navajo country to troubleshoot solar power generating units at homes in rural areas.

The program, carried out with technical support from the U.S. Department of Energy's (DOE) Sandia National Laboratories/New Mexico (Sandia/NM), is the largest of its type in the country. It provides for the NTUA to buy 200 photovoltaic systems for \$2 million and install units at individual residences. Sandia/NM engineers then provide the follow-up care to make sure the units are properly installed and working as intended. Photovoltaic units collect energy from the sun and convert it into electricity. Batteries store the electricity for future use in the home.

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explosives are fired. A tent or canopy covers many of the shot components when experiments are conducted.

Each shot generates waste, foremost of which are gravel and fragments of wood, metal, and glass. Larger debris consists of tent poles, wood, steel, aluminum, concrete, plastic, glass, burlap bags, cables, and other inert testing materials. These wastes may be contaminated with low levels of depleted uranium, tritium, and thorium. Small amounts of lead, beryllium, copper, barium, and vanadium may also be present.

Kent Haslam, Site 300 B Facility Manager, and West Firing Area Bunker Supervisor Jack Lowry provide top-down support for the hands-on efforts of engineer Bob Kuklo, engineering support technician Tom Rambur, and technical release representative Barbara DeRoos. Together, their work provides a perfect illustration of how pollution prevention measures can be integrated into Stockpile Stewardship experiments.

P2 in B Program experiments

As part of the design for recent B program experiments, Kuklo and Rambur identified and evaluated pollution prevention opportunities. With logistical support from DeRoos, they incorporated those measures that were both technologically and economically practicable into the experimental set-up. Here are some examples of the major changes in procurement practices and waste generation they have instituted in recent shots:

Test stands

- Steel tables are used instead of wood tables for some experiments, resulting in a reduced volume of debris after shots. The top of the steel table is removable and can be turned over for additional use. Steel tables are reused 20 times, wood tables only once.
- Typically, two tables are used per shot. Two wood tables (\$1,400 each) cost approximately \$2,800 for a single use. The initial investment for two steel tables (\$1,500 each) is \$3,000, but they can be reused approximately 20 times at a cost of \$220 total per shot after the initial investment—savings on subsequent shots are thus more than \$2,500 per shot. The metal tables can also be adjusted for leveling, saving experiment set-up time.
- For shaped-charge experiments, a reusable target rail, adjustable for height modification, is used. Parts are disassembled for replacement as needed. Previously, 4 x 8 foot wood tables were used in experiments. The reusable rail eliminates combustible wood waste, and it is easier to align. Unlike wood, the target rail is not warped by moisture, which in the past resulted in misalignment problems that impede data recovery.
- A concrete block within a steel box is also used as a table. It is low to the ground and can be reused, since the box protects the concrete. The volume of waste from table debris is thus minimized. An additional benefit: the concrete block table's

stability is not affected by the wind.

- Mirror stands and mirror holders are constructed of 80-20 aluminum instead of wood. Waste is minimized because the 80-20 aluminum stands and holders can be disassembled and rebracketed for reuse, and emissions from burning wood have been eliminated. Also, aluminum stands are more stable and less susceptible to drifting during testing, where the stands must be up to six feet tall. Ninety percent of the aluminum materials are recovered and reused. After an initial investment of \$2,600 for aluminum holders, stands, and brackets for the first shot, only \$180 is needed in replacement parts for subsequent shots. If the stands and holders were constructed from wood, they would not be recoverable, and the cost would be \$2,060 per shot.

Cabling

- Cable from inside the bunker to the table is protected to promote reuse. In the past, approximately 14 feet of cable was expended after each test. Now, it is protected, visually inspected and, if it appears undamaged, is ohm-tested to verify that it is acceptable for reuse. If it can be reused, new terminals are applied to the cable ends and the cables are sent to the High Explosives Applications Facility at LLNL or to other Site 300 firing facilities for reuse.

- Detonation cables can be procured in two lengths, 60 feet and 90 feet. The minimum length of cable is used, and cables are protected during shots and then evaluated for reuse.
- Half-pipes, buried and covered with gravel, are used instead of sandbags to protect data cables from shrapnel on the firing table. This measure reduces the amount of waste and provides better protection and reuse of the cables.

Tents and Canopies

- Tents can be purchased in a variety of sizes (10 x 10, 20 x 20 and 40 x 40 feet). The smallest size that will comfortably accommodate the

experiment is selected. If practicable, smaller sunshield canopies are used instead of full tents, minimizing the amount of tent-debris waste generated.

- Following the shot, large pieces of tent material are recovered, sized, and reused in subsequent experiments as external covers for auxiliary parts.
- Tent poles are inspected for reuse. If they are too damaged, they are cut to shorter lengths to minimize void spaces and maximize the amount of waste placed in the waste container.

Camera Ports

- Steel camera ports are used instead of plywood, reducing wood debris.
- Experiments typically involve the use of one to five camera ports. Camera port glass parts (eight and 12 inch diameters)

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Photo courtesy of Don Gonzalez, LLNL.

Tom Rambur (left) and Bob Kuklo align the precision laser for a typical shape charge warhead test at Site 300, Lawrence Livermore National Laboratory.

An ounce of pollution prevention is worth a million pounds of runoff

Only eyewitnesses to the power and insatiable hunger of a fire such as May's Cerro Grande blaze can fully comprehend the peril that firefighters and the region's human and non-human inhabitants faced as flames ravaged the town of Los Alamos and the dense pine/fir forests around it. Heroic action minimized much of the conflagration's threat—flames consumed more than 48,000 acres, 37 million trees, and 219 residences; however, the fire was fought successfully enough to save many properties. Most significantly, not one human life was lost—11,000 inhabitants and hundreds of family pets were safely evacuated.

One struggles to imagine combating an inferno that sometimes instantly jumped three-quarters of a mile, its embers being 100 percent incendiary (there was 100 percent chance that a glowing spark would become a flame once it contacted dry fuel). By merely surveying the ashen gray and charcoal wasteland of forests and the crumbled perimeters of houses which had literally exploded from the heat, the untrained eye could not detect the wicked traps that might be triggered by late summer monsoons and early autumn rains.

One of the largest fires in New Mexico's recorded history has been suppressed, but work remains to mitigate the potential for devastating environmental impacts, primarily from flooding. The effects of the fire could have been worse but for precautionary measures taken before the blaze. Efforts that began shortly after it and those that will continue indefinitely, *did* and *will* prevent pollution in the very truest sense.

Before: Thanks to knowledge gained from the nearby Dome Fire in 1996 and subsequent studies which identified fire dangers and quantified area fuel loads, Los Alamos National Laboratory (LANL) had established forest management and fire prevention practices which reduced the fire threat to Laboratory facilities. Discretionary thinning of the forests near facilities like TA-18 and TA-54, which housed radioactive material, prevented the incineration of many more structures. (The lab actually lost 39 buildings, most of them portable.) Had more funding been available, LANL would have pruned and thinned even more of its evergreens, offering free cut-to-length firewood logs to the public and making mulch from woody debris. (See 4th Qtr 1998 *Pollution Prevention Advisor*.)

Afterward: Aircraft dumped millions of gallons of water on the fire and smoldering timbers; after the burned surface had adequately cooled, helicopters began dropping wattles (long, cylindrical, hay-stuffed logs). These were strategically placed perpendicular to the hillside slopes to slow water flow and inhibit runoff erosion. Downed timbers that could turn into

battering rams, known as "killer logs" once they are picked up and carried by briskly moving channels of runoff, were either moved or staked firmly in place across the slope of the land. Burned out trees posing a safety threat were felled and removed.

In burned-over areas, aerial reseeding and hydromulching were performed with particular regard for future environmental impacts. Rather than using sheep fescue, which competes with young Ponderosa pine saplings, crews reseeded with slender wheat grass, a soil-stabilizing ground cover which disappears as native grasses take over.

Because of contaminated runoff potential from the rubble of private homes, suspect areas of debris were stabilized with a foam material even before homeowners were allowed to return to their properties—a stern but prudent measure.

Ongoing: One unusual result of a fire that "crowns" (burns through the treetops) in an evergreen forest is the creation of hydrophobic soils. Heat causes the conifer resins to vaporize; the volatilized sap then condenses and falls to the ground, so permeating the soil that water merely rolls off the slick, grey surface. Thus, hydrophobic soil speeds surface water on its way downhill. This phenomenon, coupled with reduced ground surface absorption due to 40-100 percent vegetation loss over much of the burned area, creates an even greater potential for erosion and flooding. To counteract these effects, volunteers have spent months raking contours into the flame-hardened soil and breaking up its crust.

Additional activities to slow the runoff water and reduce its carrying capacity are in motion. In addition to log and debris removal, LANL has selectively retrieved certain contaminated sediments and the lab is working with the U.S. Army Corps of Engineers to construct a large flood-retention structure upstream of TA-18 in Pajarito Canyon to protect the vulnerable site in the canyon bottom.

The Laboratory is draining and dredging reservoirs and strategically located low areas in the watershed, providing "speedbumps" for the potentially huge runoffs that could exceed all design capacities for culverts, fill bridges, and other engineered features. Lab crews are also constructing low-head weirs which will further slow the water flow and act as sediment traps.

Addressing concerns that ash, sediments and other contaminants of runoff pose a potential threat to fish and other aquatic organisms, professional expertise and computer models are helping determine both *what* contaminants may be present in regional sediments/runoff and to *where* they will most likely

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Volunteers rake contours across a slope to help prevent disastrous runoff in the aftermath of the Cerro Grande fire.



Workers near Los Alamos National Laboratory thin the pine/fir forest and clear the understory, management practices that will avert catastrophic burns like Cerro Grande.

Recycling returns go up as Building 913 comes down at Sandia/CA

Thanks to funding from the Defense Programs Pollution Prevention Program (DP-42), in 1999 Sandia National Laboratories/California (Sandia/CA) revised the lab's Master Specifications to incorporate language that requires the recycling of construction materials and reduction in the generation of construction waste. These recycling/waste reduction requirements were written into the Request for Quotation and the final contract for the deconstruction of the lab's Building 913.

Sandia/CA's Building 913 was a large, single story building with a footprint of approximately 84,500 square feet, which included a 20,000-square foot high bay area. The building was about 18 feet from floor to ceiling, with the high bay at about 35 feet. Since its construction in 1959, it has housed facility shops and materials research laboratories that brought together many of the organizations and functions necessary to produce mockup assemblies for weapons testing.

Building 913 defense activities involved using toxic and hazardous chemicals as well as radioactive materials (primarily depleted and natural uranium). Originally, the building housed a mockup assembly group, machine shop, plating shop, paint shop, welding shops, electrical and mechanical shops, plastics research laboratories, and an area to handle contaminated materials.

Following the guidelines in Sandia/CA's Master Specifications, Westpac Engineering Corp. included recycling in their bid for deconstruction of Building 913. By factoring into its projected costs the potential income from the sale of the recycled debris, Westpac

submitted a lower bid than would have otherwise been possible.

Even before deconstruction began, waste reduction practices were implemented in Building 913 decommissioning. Several pieces of the remaining equipment were sold to fund new-technology replacements, netting over \$35,000, while most—about \$200,000 worth—was either reused at Sandia/CA or sent to other Department of Energy facilities for reuse.

Next, after a detailed grid characterization, a needle gun was used to decontaminate localized sections—28 square meters—of the concrete slab floor instead of removing and disposing of the entire slab. Needle gun decontamination generated only 0.11 cubic meters of LLW waste, as opposed to 183 cubic meters if the whole slab was removed, an estimated cost avoidance of \$160,000.

Actual deconstruction of Building 913 started in March. Recyclable

materials from the building were segregated according to type—shredded metal, copper, structural steel, sheet metal, tin, aluminum, electronic components, yellow brass, electric motors, and non-ferrous metals—and taken to recycling facilities, netting the contractor \$42,500.

A total of 636.83 metric tons of other building materials such as gypsum, fiberglass, and fiberboard were disposed of in landfills, at a cost of about \$20,000 to the contractor. In late July, after final characterization, the contractor began removal of the remaining concrete slab and related concrete material for recycling.

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Based on revisions to the site's Master Specifications, many materials from the recent deconstruction of Building 913 at Sandia National Laboratories/California were recycled by the contractor.

Governor extols KCP's supercritical CO₂ plastic cleaning process

In August, a team of Honeywell engineers from the Department of Energy's (DOE) Kansas City Plant (KCP) was presented the Missouri Chamber of Commerce's "2000 Governor's Pollution Prevention Award" by Gov. Mel Carnahan for developing a unique technology to recycle discarded motor oil bottles. Shown during the August ceremony are (from left) Mike Henry, George Bohnert, Tom Hand, and Ron Olson, co-inventors of the patent process; Gov. Carnahan; Kelly Gillespie, Vice-President of Governmental Affairs for the Missouri Chamber of Commerce; and Steve Mahfood, Director of the Missouri Department of Natural Resources. In 1994, through the DOE Technical Assistance Program, the KCP engineers were asked to help a small business in Iowa recycle used plastic oil containers. The team found that when oil-contaminated plastic chips are "washed" with supercritical CO₂, the result is clean plastic chips and usable oil. (See 3rd Quarter 1998 *Pollution Prevention Advisor*.) Honeywell patented the "Method to Separate and Recover Oil and Plastic From Plastic Contaminated with Oil" in 1998 and recently licensed the technology to a company named Itec, Inc., which plans to sell cleaning equipment based on the technology to oil bottle manufacturers and recyclers globally.



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SRS HLW operator has something super up his sleeve



Roger Brown, a high level-waste (HLW) operator at the Department of Energy's (DOE) Savannah River Site (SRS), has engineered a portable containment and protection "sleeve" that manually dispenses a plastic protective sheath, or "sleeve," to encase long, small-diameter objects such as hoses. When used properly, the sleeve contains leaks or protects the item from external contamination. Brown's sleeve seals off cylindrical articles in less than a tenth of the time it takes to cover them without the device—a 200-foot water hose can be sleeved in less than two minutes versus the usual 45 minutes. Applications for the sleeve at DOE sites are many and the cost savings could be tremendous. For example, SRS uses over 1.7 million feet of air hose per year in various operations around the site, many in radiologically controlled areas—most applications are one-time only because of release difficulties, with the hoses disposed of as low-level waste (LLW). Reusing air hoses protected from contamination by sleeves would avoid \$1,088,000 in replacement costs and 1,700 cubic feet of LLW at a cost of over \$3,000,000 each year. Other potential applications include water hoses and extension cords taken into radiologically controlled areas.

Deployment of Brown's invention at SRS began in January; when fully implemented, its use should avoid around 17,000 cubic feet of LLW annually. Arthur Desrosiers, vice-president of Bartlett Services, recently visited SRS to see the sleeve demonstrated. His company has since licensed the device and plans to produce it commercially under the name SuperSleeve™.

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From 'Navajo Tribal' on page 1

"The only way for many of these people to have electricity is to provide each household its own photovoltaic unit," said Jimmie Daniels, NTUA solar program manager. The utility offered this alternative power source to its customers because the cost of stringing wire over parts of the reservation's rural terrain is prohibitive, Daniels explained.

Between 10,000 and 30,000 Navajos are estimated to live without electricity throughout the reservation that covers parts of New Mexico, Arizona, and Utah. The solar panels may provide the first peek out of rural isolation that exemplifies life for many on the reservation—including use of electric lights at night for schoolkids' homework as well as appliances many in the U.S. take for granted—radios, televisions and computers.

An initial solar electric home experiment was conducted by Sandia/NM and the NTUA in the early 1990s. "Based on results of that effort, the new systems are somewhat bigger, with about 600 watts of photovoltaic collectors. They will be able to convert about 3 kilowatt hours per day on average in the winter," said Roger Hill of Sandia's Renewable Energy Department, who coordinates Sandia's work with Native Americans. "That's enough electricity to power a single household for a day—if the family members are conservative in their use of electricity."

Earlier use of photovoltaics on the Navajo Nation had a problem, which is addressed in this effort—the systems sometimes failed due to lack of maintenance. The lease-purchase agreement stipulates that after 15 years, ownership and maintenance of the systems will be turned over to the homeowner.

"The people are so pleased to have the units," said Marlene Brown, a Sandia engineer who troubleshoots the systems. "Before, many of them used generators for limited power or had no power at all. Now they have power provided by a clean, quiet source."

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INEEL compost filter helps Idaho asphalt maker

People in the local community of Blackfoot, Idaho were dismayed to discover unpleasant smells emanating from Idaho Asphalt Supply Inc. after the plant began operations in 1993-94.

In an effort to assuage the public and offset the production of noxious odors and gases, the asphalt producer teamed up with



This limestone-and-woodchip composter, designed by researchers at Idaho National Engineering and Environmental Laboratory, removes 99 percent of the sulfur gases in airborne emissions from an asphalt manufacturer near Blackfoot, south of Idaho Falls.

bioremediation expert Larry Cook at the U.S. Department of Energy's (DOE) Idaho National Engineering and Environmental Laboratory. The result of their collaboration was a biofiltration unit employing 1,536 cubic feet of wood chips, slow-release fertilizers and/or crushed limestone that reduced the plant's gas emissions by 99 percent. As for the odors permeating the local neighborhood, a survey indicated that situation had been ameliorated as well. A second, improved version of the biofiltration unit is projected to reduce noxious smells to an even greater degree, Cook said.

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are accumulated on racks after use and periodically resurfaced, for up to three reuses. Port glass parts may cost from \$400 to \$1,300 each; resurfacing the port glass parts costs roughly \$150 each. Resurfaced ports have been used consistently in experiments without jeopardizing data.

Fire Sets

Steel fire-set boxes, with an externally tabled CDU to control when explosives are fired, have replaced wooden fire-set boxes. This allows experimenters to detonate explosives using a non-flammable blanket. Wooden fire-set boxes are \$360 each and generate wood debris and air emissions. The reused steel boxes have remained in good working shape for the last three years, saving an estimated \$10,000 to \$15,000 per year.

Miscellaneous P2 Measures

- In the winter, portable heating units with temperature sensors are used inside shot tents to continuously control the climate. This minimizes damage to mirrors from moisture buildup, a problem in unheated shot tents, thereby extending their useful life.
- Instead of plywood boxes, concrete tube forms are used to house the explosive candles. The explosives do not require machining to conform to the concrete tubes. In addition to reducing wood and explosives waste, the concrete tube allows more focused, uniform lighting. Concrete tubing is \$2 per foot versus \$45 per foot for plywood boxes.
- Boxes are used for shielding argon, methane, and helium, allowing shorter hoses and shorter copper lines. This reduces air emissions because there is less volatile material used.
- Shielding is often needed to protect experimental components. Instead of new shielding, excess steel armor shields from the Site 300 Corporation Yard are being used.
- For small shots, shields are being used to protect the diagnostics from the high explosives in the candle source so that the diagnostics can be recovered and reused. This reduces setup time and minimizes debris.
- A portable supply and tool trailer allows B Program personnel to cut down materials to "shot size," which generates less waste. Having the trailer on the firing table during set-up promotes the complete use of certain products instead of the generation of half-used containers.

As these examples show, source reduction is the primary means of preventing pollution in B Program experiments. As part of the pre-shot procedure in each experiment, test components and materials are screened to identify RCRA and State of California hazardous components, and substitutions are made if possible.

A regulatory-compliant disposal path for the waste generated is arranged; however, even after a disposal path has been established, B Program scientists, engineers, and technologists work to minimize the volume of waste generated.

"A vital part of making the change (to integrated pollution prevention) is having a procurement person hunt down the environmentally friendly options," said LLNL Defense and Nuclear Technologies Directorate Environmental Assurance Manager

Marjorie Gonzalez. "Tom (Rambur) and Bob (Kuklo) usually have in mind the kind of material they think will work for the experiment and how they can minimize pollution and waste. Finding it is another thing! Enter Barbara (DeRoos). She locates and procures the appropriate material at the lowest cost.

"The leadership shown by Tom and Bob in the pollution prevention arena is strongly supported by their coworkers and line managers, all of whom have had a role in making their efforts a success," Gonzalez continued. "It is an illustration of how pollution prevention can

successfully be integrated into Defense Programs activities and the value of the measures identified, developed and implemented by workers performing Stockpile Stewardship work."

Currently, B Program's P2 leaders are partnering with their counterparts in the Big Explosives Experimental Facility (BEEF) at the Nevada Test Site on the transfer of Site 300 pollution prevention measures in high explosives testing that are appropriate for BEEF operations.

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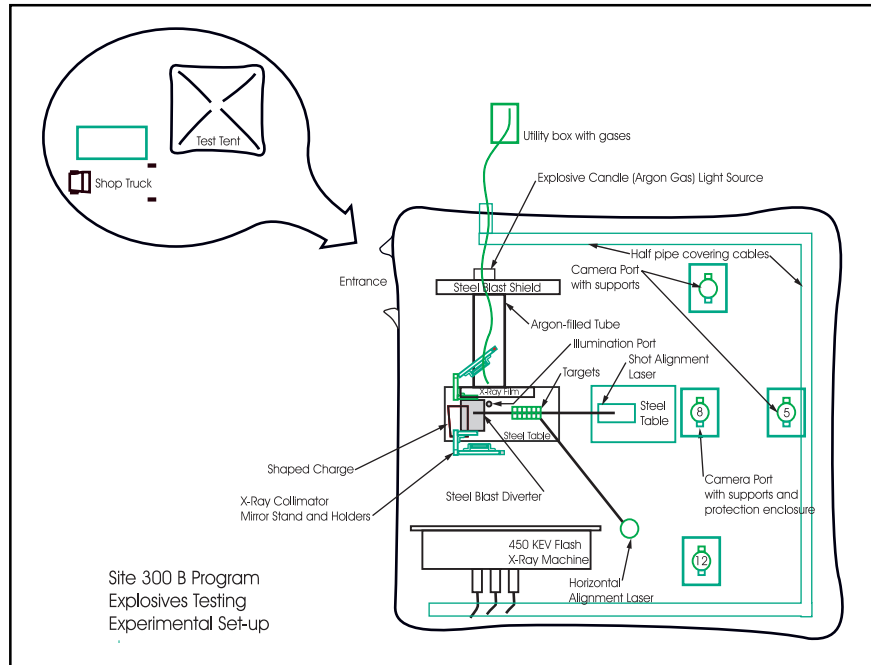


Diagram of a typical "shot" in B Program experiments. The innovative pollution prevention measures described on page 2 and on this page are outlined in green.

Between 1989 and 1993, Site 300's B Program, led by Fred Sator, Eric Frahm, and Larry Simmons, developed and introduced measures into high explosive experiments that reduced the mixed-waste (now low-level waste) stream by greater than 90 percent—from 500,000 kg per year in 1988 to less than 50,000 kg per year by 1995. (See 3rd Quarter 1997 *Pollution Prevention Advisor*.) Thanks to the continuing efforts of Kuklo, Rambur, DeRoos and others, supported by managers Haslam and Lowry, the size of the B Program waste stream is still shrinking. "Attending the (biannual) Defense Programs P2 technology workshops has consistently sparked the interest of our workers," said LLNL Defense and Nuclear Technologies Directorate P2 Coordinator Gonzalez. "The workshop programs have been so effective at reaching the workers and enabling them to integrate P2 seamlessly into our work. They come back challenged and ready to try new ideas!"

From 'Fire at Los Alamos' on page 3

migrate. The State of New Mexico's Environmental Department has already conducted assessments of contaminants from burned homes. The agency sampled, mitigated, and launched full-scale cleanups of those sites to preclude contaminant migration. The U.S. Department of Energy and LANL have also thrown tremendous resources into controlling water and sediment flows into the Rio Grande River. Finally, almost all mitigation efforts necessitate paperwork, including contingency plans for flooded entrances and egresses, breach analyses for overtopping scenarios, and expanded monitoring plans.

Now: As of this printing, the monsoon season is nearly over and no catastrophic rain events have occurred. Although the Los Alamos region may see a few more storms, these are often not as intense and localized as the summer monsoon thunderstorms. The seasonal precipitation will begin to be more dominated by more gentle frontal storms. The outlook is cautious optimism. Laboratory staff will continue to function as stewards of these burned over lands by

working for several more years to control flooding and prevent erosion, reseed and mulch as necessary, and monitor the effectiveness of these actions.

In summary, as bad as the Cerro Grande fire *was* and as devastating as future flooding could *still be*, the effects could have been many magnitudes worse save for preventative measures performed by people who knew they could make a positive difference. Many experts now feel we have learned more about how we interact with and are an important part of the surrounding natural environment—about how important our interfaces with our environment and our neighbors and fellow 'stewards' are. This experience supports the concept that there is an overwhelming responsibility to maintain the efforts that have been started and the institutional consciousness that stewardship is not an option—it is part of the critical role we play in the grand scheme of things.

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Thinning New Mexico's forest for fire: enough, but not too much

Many conservationists and wilderness preservationists don't realize that in many of New Mexico's state and national forests and wildlife management areas the densely packed conifer situation (900-1000 "stems" per acre) bears no resemblance to the "forest primeval." The forest management practice of thinning trees down to 50-100 stems per acre is criticized as interfering with the forests' "natural" progression and succession.

However, fire-free habitats such as those maintained on public lands are not themselves natural. The pre-Columbian woodlands in this area were mature, much less dense, populated with tall, fire-resistant Ponderosa pine, open beneath with relatively little understory. During that era, when lightning-ignited grass fires still swept the forest floor, the flames encountered conditions not unlike today's thinned stands rather than the higher density of non-managed forests.

Cross sections of several-hundred-year-old trees in this region reveal a reasonable estimate of when the natural 5-20 year cycle of forest fires ceased. Determining *why* they stopped when they did (in the late 1800s) requires a little deductive reasoning. In the late 1800s, the railroad first entered New Mexico. Railroad cars carried livestock, and the transplanted sheep, cows, horses, and goats immediately began to eat the understory fuel which formerly would catch fire and burn quickly through the woods, keeping all but the tallest pine saplings down. Then in 1910 the official decision to suppress all fires was made. The job was easy because the fires were always surface fires.

Then the forest changed.

Fires had favored the Ponderosas. When fires were suppressed, other tree species such as Douglas and white fir gained footholds. As fireless years passed, various stages of vegetation created a virtual ladder of fuel from which accidental and unintended fires could move from the ground surface into the interlocking crowns of trees. Crown fires increase the likelihood of much taller flames and blazes that "spark out" up to a mile away, depending on the winds. Fuel ladders also make the fires hotter and hence even resistant plants, such as those with thicker barks like the Ponderosa, are no longer impervious to the flames. Pinons and junipers can also survive ground fires, but crown fires destroy them, in turn gaining strength from their volatile resins. A conflagration feeding from so much available fuel can cause total destruction. The forest will not fully recover for many decades.

Although the high desert of New Mexico has witnessed numerous fires, there are positive aspects within the aftermaths. For example, 1977's La Mesa (one of the hottest blazes) burned 16,000 acres, yet within days the burned-over land exhibited oak and aspen sprouts with New Mexican locust not far behind. Next to thrive in La Mesa's ashes were wildflowers such as Indian paintbrush and thistle, temporarily bigger than usual due to decreased competition for sunlight and nourishment. Fecundity, the abundant resiliency of life, can be more difficult to suppress than controlled burns gone awry.



Mechanical thinning and removal of the "ladder of fuel" from the understory of the pine/fir forests in northern New Mexico are used to approximate pre-settlement conditions in which regular wildfires actually benefitted forest growth.

DOE energy efficiency initiatives to aid sustainable growth in Asian-Pacific partner countries

The U.S. Department of Energy will launch new energy efficiency initiatives as a result of the Asia-Pacific Economic Cooperation (APEC) Energy Ministers Meeting, attended by Energy Secretary Bill Richardson. The May meeting was held to encourage the use of renewable energy for sustainable economic

development and growth. An APEC Private Sector Renewable Energy Forum is planned to start this effort late this year or early next year. A second initiative will aid the development of energy efficiency standards, testing procedures and labeling in APEC member countries, including the U.S.

Looking for new ideas for your P2 program? Want to encourage and train line workers, engineers, and technicians to "go beyond P2?" Send them to Oregon at the end of October! And come along yourself to the **Defense Programs' 17th Biannual Pollution Prevention Hands-On Training Technology Workshop**. Beginning Oct. 31 and continuing through Nov. 2 at the 5th Avenue Suites Hotel in Portland, Ore., some of the Northwest's and DOE's most capable speakers will lead you in exploring topics like P2 in Integrated Safety Management Systems, E013148: "Greening the Gov't Through Leadership in Environmental Management," and sustainable building techniques. Then, during site visits, you and other participants in small working groups will interact with "P2 Champions" at some of the region's leading industries. You'll find out how they have overcome challenges like the ones you face at your facility to become exemplary environmental stewards. Group topics include: Design for Environment, Environmental Management Systems, Energy Efficiency, Conservation & Recovery, Environmental Teams, Implementing Sustainability in a Company, Sustainable Construction, and Transportation Options. As with all DP Biannual Workshops, there is no registration fee. So what are you waiting for?

To register, go to <http://www.dp.doe.gov/dp45/p2/portland/> or contact Julie Lyons, MER, Inc., 423-543-5422 or mers@usit.net

In his memory

Bob Kleppner, who coordinated printing of *Pollution Prevention Advisor* and *ESAVE* from DOE Headquarters in Germantown, died suddenly at his home on Saturday, August 26.



Bob was a professional in all aspects of printing, who, when asked generously advised us on everything from choice of paper and ink to folding techniques. Without him this newsletter would not have improved as it did from its early beginnings, lasted this long, nor been as effective. Along with everyone who was associated with Bob throughout DOE, we will miss him.

-The *ESAVE* Staff

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